

**REMARKS**

This amendment is responsive to the non-Final Office Action of February 18, 2010. Reconsideration and allowance of claims 1-13 and 15-19 are requested.

**The Office Action**

Claims 1-5, 7, and 15 stand rejected under 35 U.S.C. § 101.

Claims 1-4 and 15 stand rejected under 35 U.S.C. § 112, first paragraph.

Claims 1, 4-13, and 15 stand rejected under 35 U.S.C. § 103 based on the brief summary of the Fitzpatrick reference and the Maintz reference set forth in the background portion of the present application.

Claims 2 and 3 stand rejected under 35 U.S.C. § 103 over the summary of Fitzpatrick and Maintz, as further modified by Grimson (US 5,531,520).

**35 U.S.C. § 101**

Claim 1 has been amended to add a transforming step. Accordingly, it is submitted that claims 1-4 and 15-19 dependent therefrom now comply fully with the requirements of 35 U.S.C. § 101.

Claims 5 and 7 have been amended to specify that the computer readable media is tangible, so as to exclude transitory propagating signals. Accordingly, it is submitted that claims 5 and 7 comply fully with the requirements of 35 U.S.C. § 101.

**35 U.S.C. § 112, First Paragraph**

In the preferred embodiment described in the present application, the preset angular offset is described as being 90°. Specifically, the first current and earlier reference slice images are brought into agreement with one of the foot-head (FH), anterior-posterior (AP), or right-left (RL) directions and the second current and earlier reference slice images are brought into agreement with a different one of the foot-head, anterior-posterior, and left-right directions. The foot-head, anterior-

posterior, and right-left directions are known in the art and are known by definition to be orthogonal to each other.

Because the present application clearly describes a preset angular offset, namely orthogonal, it is submitted that the claims comply fully with the requirements of 35 U.S.C. § 112, first paragraph.

Page 1, line 27 – page 2, line 7 has been retracted.

The applicant has retracted the summary of Fitzpatrick and Maintz which appear on page 1, line 27 – page 2, line 7 of the application as filed. This summary of Fitzpatrick and Maintz would either be recognized by one of ordinary skill in the art as being inaccurate or as being inaccurately interpreted by the Examiner. In either case, it is confusing and subject to misinterpretation.

The Fitzpatrick and Maintz references have been considered by the Examiner in three Office Actions. Yet, neither Fitzpatrick nor Maintz have ever been applied against the claims, strongly suggesting that the claims distinguish patentably over Fitzpatrick and Maintz. Because the claims distinguish patentably over the underlying references, it is submitted that the Summary must be either inaccurate or so unclear or indefinite that it is easily misinterpreted by the Examiner and others.

**The Claims Distinguish Patentably  
Over the References of Record**

First, because the Examiner's primary reference has been removed by the retraction of page 1, line 27 – page 2, line 7, it is submitted that there is no valid art rejection against any claim. Accordingly, it is submitted that all claims distinguish patentably over all references of record.

Second, it is submitted that one of skill in this imaging arts would interpret page 1, line 28 to call for calculating a geometric transform based on a current reference slice image. Note that the current reference slice image is in the singular. That is, there is one reference slice image. It is submitted that the earlier reference slice images (in the plural) set forth on line 1 of page 2 would be recognized by one of ordinary skill in the art as being earlier reference images to the earlier images all of which are intended to be of the same slice as the current reference slice image. However, due to patient motion, differences in positioning the patient in

various imaging sessions, or the like, the current and earlier reference slice images are not exactly aligned. If they were, there would be no need for either the prior art or present alignment techniques.

What is not expressed in the summary but known to those of ordinary skill in the art, is that the current reference is typically one of the diagnostic slice images to be generated, but with lower resolution. Also understood by those of ordinary skill in the art, the earlier reference slice images were used to generate earlier diagnostic slice image data sets. Accordingly, it stands to reason, that if one determines the geometrical transform which transforms the current reference image into alignment with an earlier reference image, then that same transform will describe how one would transform the current diagnostic slice images into alignment with one of the earlier diagnostic slice image data sets.

What is also known by those of ordinary skill in the art is that transforming diagnostic images tends to degrade the resolution and can have other drawbacks. Accordingly, the parameters of the scanner which generated the current reference slice image are adjusted in accordance with the transform such that they will come out of the scanner inherently aligned with the earlier diagnostic slice image data set.

Although not stated in page 1, line 27 – page 2, line 7, instead of a single current reference image, one of ordinary skill might take a modest number of parallel current reference images, for example, one corresponding to the first slice of the image of the volume to be imaged and the last slice image of the volume to be imaged by the diagnostic slice images. One might even generate a modest number of current reference slice images parallel to the first and last slice of the volume, but this carries a disadvantage in the form of a temporal penalty for generating the extra images. Because these parallel reference slice images are widely spaced in the image volume, the resolution within the plane of the current reference slice image(s) is typically much greater than in the distance between planes, i.e., the direction perpendicular thereto. This has the disadvantage that the accuracy with which the imaging parameters can be calculated is often not high enough. If the accuracy is not high enough, then the set of current diagnostic slice images of the image volume will not be accurately aligned with the slices of earlier sets of diagnostic slice images of

the same volume. If the slices are not aligned, errors occur. If one mathematically tries to transform the slice images into better alignment, there is a penalty in both resolution and time.

As set forth on page 2, starting at line 22, it is an object of the present invention to allow the imaging parameters to be calculated more accurately while using only a minimal amount of time to generate the reference slice images. The preferred embodiment of the present application discloses achieving this improvement by taking not just one or more parallel reference slice images generated along one of the directions, e.g., the right-left direction. A second one or more reference slice images are generated along the anterior-posterior direction. One or more third reference slice images are generated along the foot-head direction. Even when only a single reference image is generated along each of the anterior-posterior direction and the foot-head direction, there is now accurate information in two planes orthogonal to the image plane. This additional information leads to greater accuracy in the transform and greater accuracy in selecting the parameters for generating the diagnostic slice images.

By way of example, if one wants to make a series of images of a volume including the spine at each of a plurality of different periods of time, according to the prior art summary, one would generate one or more earlier reference slice images parallel to the intended diagnostic image slices, e.g., orthogonal to the spine. At some time later, when the patient is brought in for another imaging session, the subject is positioned in what is intended to be the identical position as in the earlier imaging session. If the patient is positioned slightly left or right, or if the imaging table is raised slightly, the technique described in the prior art summary can make adjustments for this vertical or horizontal offset. However, if the patient is positioned with the spine extended or compressed or curved relative to the position of the spine in the earlier imaging session, it will be difficult to determine this curvature by comparing earlier and current parallel reference slice images leading to inaccuracies. However, as in the present application, if there is an additional reference slice image extending through the spine in a vertical plane and another reference image extending through the spine in the horizontal plane, these differences in the positioning of the spine can be much more accurately determined, hence the

imaging parameters for the diagnostic slice images can be performed with much greater accuracy.

In the discussion regarding claims 1 and 5, the Examiner acknowledges that the alleged prior art does not disclose reference slice images in a second orientation which is differently oriented by a preset angle. The Examiner erroneously asserts that the applicant has not disclosed that such a preset angular offset solves any particular problem or presents any patentable advantage. To the contrary, the Examiner's attention is directed to page 2, lines 12-21 which sets forth the disadvantages of the prior art method, page 2, lines 22-26 which sets forth the advantages of the present technique, page 3, lines 1-19 which sets forth additional advantages, and page 4, lines 27-28 which set forth further advantages.

Dependent claim 4 further characterizes the reference slice images as including slice images in each of the head-foot, anterior-posterior, and right-left directions. These directions being orthogonal, claim 4 inherently defines the present angular offset as orthogonal. Further, the summary of the prior art makes no suggestion of images in more than one direction.

Claim 15 specifies that the present angular offset is orthogonal.

Claim 16 calls for the reference slice images to be along two of the head-foot, anterior-posterior, and left-right directions such that the preset angular offset is 90°.

Claim 17 calls for reference slice images along all three of the head-foot, anterior-posterior, and left-right directions.

Accordingly, it is submitted that claim 1 and claims 2-4, and 15-19 dependent therefrom are different from, advantageous over, and distinguish patentably over the references of record.

The Examiner appears to assert that claim 5 calls for the reference slice images to be differently oriented by a preset angular offset. A careful review of claim 5 shows that the reference slice images are required to be perpendicular to each other. As pointed out above, the present application sets forth numerous advantages for having perpendicular reference slice images. This limitation finds clear antecedent basis in the application. See, for example, page 4, lines 22-24. The advantages for the orthogonally oriented reference images is not a mere choice of

design, but achieves significant advantages such as set forth at page 4, lines 25-28 and other places in the application.

Accordingly, it is submitted that claim 5 and claim 7 dependent therefrom distinguishes patentably and unobviously over the references of record.

In the rejection of claim 6, the Examiner erroneously states that systems of the prior art generate reference images along each of two different orthogonal directions. By contrast, page 2, lines 15-17 indicates that the resolution of the reference slice images is greater than resolution in a direction perpendicular to the reference slice images. This does not state that reference slice images are generated in the perpendicular direction. Rather, those of ordinary skill in the art would clearly recognize that the difference in resolution is because the spacing between the prior art reference slice images is greater than the distance between pixels within each reference slice image.

The applicant specifically challenges the Examiner's assertion that it would be obvious to choose non-parallel reference images. Pursuant to MPEP § 2144.03, the applicant challenges this assertion and call upon the Examiner to provide appropriate prior art in support thereof.

Accordingly, it is submitted that claim 6 and claims 7, 8, and 9 dependent therefrom distinguish patentably and unobviously over the references of record.

Claim 10 calls for the reference slice images to be oriented along at least two of head-foot, anterior-posterior, and left-right directions. The prior art summary, referenced by the Examiner, neither discloses, teaches, nor suggests reference images with such orientations. Pursuant to MPEP § 2144.03, the applicant challenges this assertion of obviousness and puts the Examiner to her proofs to provide appropriate reference or affidavit evidence in support thereof.

Further, the Examiner, as discussed above in conjunction with claim 6, has misinterpreted page 2, lines 15-17. Accordingly, it is submitted that claim 10 and claims 11-13 dependent therefrom distinguish patentably and unobviously over the references of record.

On page 5, second paragraph, the Examiner asserts that any slice image inherently has an orientation relative to a head-foot, anterior-posterior, and

left-right direction. However, this is not what claim 4 or 13 called for. Claim 4 calls for the reference slice images to be *in* the head-foot, anterior-posterior, and left-right direction. The preselected orientation set forth in claim 1 relates to the orientation between reference slices.

Moreover, the prior art summary on page 1, line 27 – page 2, line 7 does not reference head-foot direction, anterior-posterior direction, and left-right direction.

Accordingly, it is submitted that the Examiner's assertion that the prior art summary discloses the subject matter of claims 4 and 13 is erroneous and should be withdrawn.

On page 5, paragraph 2, the Examiner erroneously asserts that the orthogonal reference slices are not disclosed as solving any particular problem. To the contrary, the problem is disclosed in the present application at page 2, lines 12-21. Note also the discussion in conjunction with claim 1 regarding the achieved advantages.

Accordingly, it is submitted that claim 15 does achieve new and unexpected results and distinguishes patentably over the references of record.

**MPEP § 2144.03**

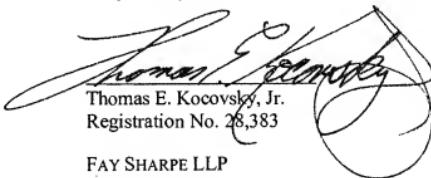
The applicant hereby challenges all assertions of obviousness without the courtesy of citing a supporting reference. Pursuant to MPEP § 2144.03, the applicant hereby puts the Examiner to her proofs to provide appropriate references or affidavits in support of such assertions of obviousness or what is known in the art.

**CONCLUSION**

For the reasons set forth above, it is submitted that claims 1-13 and 15-19 distinguish patentably and unobviously over the references of record and meet the other statutory requirements. An early allowance of all claims is requested.

In the event the Examiner considers personal contact advantageous to the disposition of this case, the Examiner is requested to telephone Thomas Kocovsky at 216.363.9000.

Respectfully submitted,



Thomas E. Kocovsky, Jr.  
Registration No. 28,383

FAY SHARPE LLP  
The Halle Building, 5th Floor  
1228 Euclid Avenue  
Cleveland, OH 44115-1843  
Telephone: 216.363.9000 (main)  
Telephone: 216.363.9122 (direct)  
Facsimile: 216.363.9001  
E-Mail: [tkocovsky@faysharpe.com](mailto:tkocovsky@faysharpe.com)